

**Number, Operation, and Quantitative Reasoning**

**Activity:** Let's Get Friendly!

**TEKS:** **111.15. Mathematics, Grade 3.**

(a) Introduction.

(3) Throughout mathematics in Grades 3-5, students develop numerical fluency with conceptual understanding and computational accuracy. Students in Grades 3-5 use knowledge of the base-ten place value system to compose and decompose numbers in order to solve problems requiring precision, estimation, and reasonableness. By the end of Grade 5, students know basic addition, subtraction, multiplication, and division facts and are using them to work flexibly, efficiently, and accurately with numbers during addition, subtraction, multiplication, and division computation.

(3.5) **Number, operation, and quantitative reasoning.** The student estimates to determine reasonable results.

The student is expected to:

(B) use strategies including rounding and compatible numbers to estimate solutions to addition and subtraction problems.

(3.14) **Underlying processes and mathematical tools.** The student applies Grade 3 mathematics to solve problems connected to everyday experiences and activities in and outside of school.

The student is expected to:

- (A) identify the mathematics in everyday situations;
- (B) solve problems that incorporate understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness;
- (C) select or develop an appropriate problem solving plan or strategy, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem; and
- (D) use tools such as real objects, manipulatives, and technology to solve problems.

(3.15) **Underlying processes and mathematical tools.** The student communicates about Grade 3 mathematics using informal language.

The student is expected to:

- (A) explain and record observations using objects, words, pictures, numbers, and technology; and
- (B) relate informal language to mathematical language and symbols.

(3.16) **Underlying processes and mathematical tools.** The student uses logical reasoning.

The student is expected to:

- (B) justify why an answer is reasonable and explain the solution process.

Note: Portions of this lesson address TEKS at other grade levels as well; however, the intent of the lesson fits most appropriately at the grade level indicated.

**Overview:** In this investigation, students will use compatible or “friendly” numbers to solve problems. The students will use the commutative and associative properties as efficient ways for estimating and/or adding sums. In the past, students were often taught rules for rounding numbers to the nearest ten or hundred. The emphasis was on learning the rules instead of putting the estimated number into context so that the student understood why it was helpful to round the number.

**Materials:** *Let’s Get Friendly!* – Handout/Transparency 1  
*Friendly Estimates* – Handout/Transparency 2  
*Make 100* – Handout/Transparency 3  
*Make 50* – Handout/Transparency 4  
*Mental Math or Paper and Pencil or Calculator???* – Handout/Transparency 5  
*Coyotes All Around* by Stuart J. Murphy (optional)

**Grouping:** Introductory activity – individual data collection  
 Discussion of class data – whole group  
 Handout 1 – whole group or partners  
 Handout 2 – whole group  
 Handout 3 and 4 – individual  
 Handout 5 - individual

**Time:** 1 hour

**Lesson:**

Procedures	Notes
1. Assign students the task of interviewing an adult. Students should ask the adult the following three questions and record the responses: <ul style="list-style-type: none"> <li>• Can you share with me 6–10 ways that you use mathematics in your everyday life?</li> <li>• For each of these examples, do you need</li> </ul>	Although this list could include many tasks, often adults report that they use mathematics to estimate the tip at a restaurant, to calculate how much carpet or fencing to buy, to determine if they have enough cash with them to purchase an item, and/or to

Procedures	Notes
<p>an exact answer or an estimate?</p> <ul style="list-style-type: none"> <li>When you are doing each of these tasks, do you use mental mathematics, paper and pencil, or a calculator and/or a computer to perform the calculations?</li> </ul> <p>After the data has been collected, make a class list and discuss the many ways mathematics is used in real life. Ask the class to determine if the adults interviewed used more estimated answers or exact answers. Determine which of the methods was used more often: mental mathematics, paper and pencil, or calculators and/or a computer.</p>	<p>calculate the discount on a sale item. Students usually discover that adults use mathematics every day in many ways. Most often, adults use mental mathematics, then calculators and/or computers, and least of all, paper and pencil. Many times estimates, rather than exact answers, are used in our daily lives.</p>
<p>2. In a previous lesson, the class investigated how Clever Coyote in the book, <i>Coyotes All Around</i> by Stuart J. Murphy, used the number line to round numbers so she could quickly estimate sums (see 3<sup>rd</sup> Grade student lesson entitled <i>Just Make It Easy!</i>). Estimates are useful when exact answers are unrealistic, impossible, or unnecessary. Estimation is about producing an answer close enough to allow good decisions without doing exact computations.</p> <p>Clever Coyote has a very clever friend named Cunning Coyote who has another way of estimating sums and differences. Cunning Coyote calls her method, “Compatible or Friendly Numbers.” She says it is easier to use numbers like 100, 500 and/or 800 instead of the numbers 94, 517, and/or 762 when estimating sums or differences. Cunning Coyote thinks multiples of 10 and 100 are “friendly” numbers and make estimating easy to do.</p>	<p>Dr. John Van de Walle defines compatible numbers for addition and subtraction as numbers that go together easily to make “nice” numbers. Numbers that make tens or hundreds are the most common examples. Compatible sums also include numbers that end in 5, 25, 50, or 75, since these numbers are easy to work with as well.</p> <p>The <i>Investigations Series</i> refer to compatible numbers as “landmark” numbers.</p> <p>Catherine Twomey Fosnot and Maarten Dolk, authors of <i>Constructing Number Sense: Addition and Subtraction</i>, call them “friendly” numbers.</p> <p>To round a number simply means to substitute a nice number that is close so that some computation can be done more easily.</p>
<p>3. Use Handout/Transparency 1, <i>Let’s Get Friendly!</i>, to introduce this way of estimating to the students. Searching for compatible</p>	<p>Flexible thought with numbers and many estimation skills are related to the ability to substitute a nice</p>

Procedures	Notes
pairs can be done as a whole class activity.	number for one that is not so nice.
<p>4. Show Transparency/ Handout 2, <i>Friendly Estimates</i>, for examples of the way Cunning Coyote can estimate the sum of long strings of numbers. Explain to the students that when adding a long list of numbers, it is sometimes useful to look for two or three numbers that can be grouped to make sums of 10 or 100. Often the numbers in the list can be adjusted slightly to produce these groups of 10 or 100 to make finding an estimate easier.</p>	<p>The commutative property of addition allows the addends to be placed in any order. Changing the order of the addends does not change the sum. (Commutative sounds like “commute,” which means to go back and forth.)</p> <p>The associative property of addition says that changing the grouping of three or more addends does not change the sum. These properties are wonderful strategies for students to learn to simplify the task of finding sums, whether they need to be exact or estimated.</p>
<p>5. Show Handout/Transparency 3, <i>Make 100</i>, to the class. Instruct the students to find two or more adjacent numbers in the rows or columns that add to 100. The numbers that add to 100 must be next to each other horizontally or vertically – not diagonally. Find as many combinations as possible.</p>	<p>Teachers should emphasize that numbers need to be adjacent for this game only! The purpose of these two handouts is for students to practice finding numbers that add to 100 or add to 50. In problem solving, when adding number strings, numbers need not be adjacent.</p>
<p>6. Show Handout/Transparency 4, <i>Make 50</i>, to the class. Challenge the students to find two or more adjacent numbers in the rows or columns that add to 50. The numbers that add to 50 must be next to each other horizontally or vertically – not diagonally. Find as many combinations as possible.</p>	
<p>7. Handout/Transparency 5, <i>Mental Math or Paper and Pencil or Calculator ???</i>, allows students the opportunity to think about doing computations mentally. The problems include both addition and subtraction.</p> <p>Show only the top of this transparency, and</p>	<p>Research shows that students often apply written algorithms to computations that would be more efficient to do mentally. Wise use of calculators should be encouraged. Students should not automatically use a calculator any</p>

Procedures	Notes
<p>share the two strategies given.</p> <p>Ask students if anyone can think of another way to mentally add <math>350 + 400</math>. Ask students which strategy they find easiest. Now uncover the list of addition or subtraction problems. Have students to make a list of the problems they think are easiest to solve using only mental mathematics and explain why they find that problem easy. After completing this assignment, have students reflect on what made a problem easy or difficult to solve. Record students' thoughts on a class chart.</p>	<p>more than they should automatically use written algorithms.</p> <p>As students learn to manipulate numbers mentally, they develop numerical fluency and increased confidence in their abilities to add and subtract flexibly, efficiently and accurately.</p>

**Homework:** Have students create their own problems to estimate sums and differences.

Have students create their own problems to find sums and differences.

**Assessment:** Have students create two problems that are easy for them to do mentally. Then, have the students explain how they would solve the problems and why they find these problems easy.

Have students create two problems that are difficult for them to do mentally and explain why they think those problems are difficult.

**Extensions:** Have students create a bar graph to compare the need of an exact answer to the need of an estimate based on the class data. Another graph can be created using the class data to compare the use of paper/pencil, the use of mental mathematics, and the use of calculator/computer.

**Resources:** Fosnot, C. T. & Dolk, M. (2001). Constructing number sense: Addition and subtraction. Portsmouth, NH: Heinemann.

Ma, L. (1999). Knowing and teaching elementary mathematics. Mahwah, NJ: Lawrence Erlbaum Associates.

McIntosh, A., Reys, B., Reys, R., & Hope, J. (1997). Number sense: Grades 4 – 6. Palo Alto, CA: Dale Seymour Publications.

Russell, S. J. & Rubin, A. (1998). Investigations in number, data, and space: Landmarks in the hundreds. Menlo Park, CA: Dale

Seymour Publications.

Van de Walle, J. A. (2004). Elementary and middle school mathematics: Teaching developmentally. Boston: Pearson Education, Inc.

## Let's Get Friendly!

Find pairs of numbers that make 100:

10	40	50	80	30
70	60	90	20	50

Find pairs of numbers that make 100:

65	75	15	85	95
25	35	45	5	55

Find pairs of numbers that make 50:

28	9	22	13	19
37	31	12	41	38

Find pairs of number that make 500:

125	240	350	150	375
335	260	165	85	415

Find pairs of numbers that make 1,000:

185	565	815	240	720
635	435	280	365	760

Handout/Transparency 1

## Friendly Estimates

### Somewhere Elementary School P.T.A. Pizza Kits Sales

Classes	Number of kits
Kindergarten	41
First Grade	29
Second Grade	66
Third Grade	62
Fourth Grade	81
Fifth Grade	48

At Somewhere Elementary School, the school P.T.A. challenged each class to sell pizza kits to raise money for new playground equipment. The above chart shows how many pizza kits each class sold. Estimate the total number of pizza kits sold.

Cunning Coyote explains, “I know when I add three or more numbers I can change their order and the sum will remain the same. This makes estimating sums much easier. So I would look for friendly numbers that go together to make 100. I would group 66 with 41, then I would put 29 with 81 and last I would group 62 with 48. I would know that each group went a little over 100 so I would estimate that Somewhere Elementary School students sold about 330 pizza kits.”

Handout/Transparency 2

# Make 100

Find two or more adjacent numbers in the rows or columns that add to 100. The numbers that add to 100 must be next to each other horizontally or vertically – not diagonally. Find as many combinations as possible.

<b>25</b>	<b>83</b>	<b>72</b>	<b>19</b>	<b>81</b>	<b>62</b>
<b>5</b>	<b>17</b>	<b>28</b>	<b>57</b>	<b>43</b>	<b>38</b>
<b>55</b>	<b>5</b>	<b>29</b>	<b>66</b>	<b>8</b>	<b>39</b>
<b>15</b>	<b>23</b>	<b>28</b>	<b>49</b>	<b>46</b>	<b>46</b>
<b>6</b>	<b>87</b>	<b>13</b>	<b>50</b>	<b>46</b>	<b>15</b>
<b>94</b>	<b>45</b>	<b>55</b>	<b>23</b>	<b>49</b>	<b>28</b>

Handout/Transparency 3

# Make 50

Find two or more adjacent numbers in the rows or columns that add to 50. The numbers that add to 50 must be next to each other horizontally or vertically – not diagonally. Find as many combinations as possible.

<b>16</b>	<b>25</b>	<b>9</b>	<b>12</b>	<b>25</b>	<b>7</b>
<b>26</b>	<b>33</b>	<b>17</b>	<b>38</b>	<b>25</b>	<b>4</b>
<b>8</b>	<b>19</b>	<b>3</b>	<b>22</b>	<b>30</b>	<b>39</b>
<b>16</b>	<b>31</b>	<b>47</b>	<b>28</b>	<b>20</b>	<b>15</b>
<b>11</b>	<b>39</b>	<b>24</b>	<b>36</b>	<b>14</b>	<b>35</b>
<b>9</b>	<b>41</b>	<b>26</b>	<b>31</b>	<b>6</b>	<b>13</b>

Handout/Transparency 4

**Mental Math or Paper and Pencil or Calculator???**

**Cunning Coyote explains, “With the problem  $350 + 400$  I would count on by hundreds. I would think  $350 + 100$  is  $450...550...650...750$  so the answer is  $750$ .”**

**Clever Coyote says, “With the problem  $350 + 400$  I would think  $35 + 40 = 75$  so  $350 + 400 = 750$ .”**

**How would you add  $350 + 400 = ?$**

Which of the following problems would be easy for you to do mentally if you have to find an exact answer? Why?

1.  $600 + 500$
2.  $7,000 + 7,000$
3.  $732 - 397$
4.  $150 + 200$
5.  $100 - 49$
6.  $673 + 458$
7.  $1,000 - 260$
8.  $123 + 689$
9.  $460 + 99$
10.  $758 - 567$

Handout/Transparency 5